Claims

[c1]   1. A method to control a vehicle, wherein the vehicle re-
quires torque matching between a first power source and
a second power source in order to limit noise, vibration,
and harshness (NVH) occurring during a transition from
the first power source solely providing torque to a com-
bination of the first power source and the second power
source providing torque, the method comprising:
determining a first torque estimate for the first power
source based on operating parameters for the first power
source;
determining a second torque estimate for the first power
source based on operating parameters for the second
power source;
determining a steady-state operating condition of the
vehicle;
comparing the first torque estimate to the second torque
estimate if the steady-state operating condition is deter-
mined; and
calculating a torque correction factor based upon the
comparison of the first torque estimate to the second
torque estimate, wherein the correction factor is used to
adjust the first torque estimate to control torque mis-

matching between the first power source and the second power source during the transition from the first power source solely providing torque to the combination of the first power source and the second power source providing torque.

[c2]   2. The method of claim 1, wherein the first power source is an internal combustion engine and wherein steady-state operation is determined if an engine load is within a predefined range for a predefined period of time.

[c3]   3. The method of claim 1, wherein the first power source is an internal combustion engine and wherein steady-state operation is determined if an engine speed is within a predefined range for a predefined period of time.

[c4]   4. The method of claim 1, wherein the first power source is an internal combustion engine and wherein the method further comprises storing a number of the correction factors in a memory according to an engine speed and an engine load occurring proximate a time of calculating the correction factors, wherein each stored correction factor is retrievable based on the speed and load.

[c5]   5. The method of claim 4, further comprising controlling

an amount of torque produced by the second power source based on retrieving the correction factor stored for the speed and load that corresponds with a present speed and load proximate a time of the transition.

[c6] 6. The method of claim 1, wherein the second power source is a motor/generator and wherein determining the second torque estimate comprises measuring current in the motor/generator, wherein the second torque estimate is a more accurate estimate torque provided by the first power source than the first torque estimate.

[c7] 7. The method of claim 1, wherein a first correction factor is used to adjust the first torque estimate during transitions occurring under low speed and high load, a second correction factor is used to adjust the first torque estimate during transitions occurring under high speed and low load, a third correction factor is used to adjust the first torque estimate during transitions occurring under low speed and low load, and a fourth correction factor is used during transactions occurring under high speed and high load.

[c8] 8. The method of claim 1, wherein the vehicle is a hybrid electric vehicle (HEV) and wherein the method further comprises releasing a transfer brake and controlling an amount of torque produced by the second power source

during the release of the transfer brake based on adjusting the first torque estimate according to the correction factor such that the amount of torque produced by the second power source matches the torque produced by the first power source within a predefined range.

[c9]   9. The method of claim 1, wherein the correction factor is a value determined by calculating a difference between the first torque estimate and the second torque estimate.

[c10]   10. The method of claim 1, wherein the correction factor is a weighted value of the difference between the first torque estimate and the second torque estimate.

[c11]   11. A method for torque matching in a hybrid electric vehicle (HEV) to control noise, vibration and harshness (NVH) due to a torque mismatch arising during a transition from a first state to a second state, wherein the first state comprises an internal combustion engine providing torque to a planetary gear set while a transfer brake prevents an motor/generator from providing torque to or receiving torque from the planetary gear set and the second state comprises releasing the transfer brake so that the internal combustion engine provides torque to the planetary gear set in combination with the motor/ generator providing torque to the planetary gear set, the method comprising:

determining a first torque estimate for the internal combustion engine based on operating parameters for the internal combustion engine;

determining a second torque estimate for the internal combustion based on operating parameters for the motor/generator;

determining a steady-state operating condition for the HEV;

comparing the first torque estimate to the second torque estimate if the steady-state operating condition is determined;

calculating a torque correction factor from the comparison of the first torque estimate to the second torque estimate; and

releasing the transfer brake while simultaneously controlling the motor/generator to provide torque based on the first torque estimate being adjusted according to the correction factor such that NVH during release of the transfer brake is limited.

[c12]   12. A system for use in a hybrid electric vehicle (HEV) to control noise, vibration, and harshness (NVH) due to a torque mismatch arising during a transition from a first state to a second state, wherein the first state including an internal combustion engine providing torque to a planetary gear set while a transfer brake prevents an

motor/generator from providing torque to or receiving torque from the planetary gear set and the second state including releasing the transfer brake so that the internal combustion engine provides torque to the planetary gear set in combination with the motor/generator providing torque to the planetary gear set, the system comprising:

means for determining a first torque estimate for the internal combustion engine based on operating parameters for the internal combustion engine;

means for determining a second torque estimate for the internal combustion based on operating parameters for the motor/generator;

means for determining a steady-state operating condition for the HEV;

means for comparing the first torque estimate to the second torque estimate if the steady-state operating condition is determined; and

means for calculating a torque correction factor from the comparison of the first torque estimate to the second torque estimate, wherein the correction factor is for use in adjusting the first torque estimate so that the adjusted first torque estimate can be used to limit NVH by controlling torque mismatching during the transition.

[c13]   13. The system of claim 12, wherein steady-state operation is determined if an engine load is within a prede-

fined range for a predefined period of time.

[c14] 14. The system of claim 12, wherein steady-state operation is determined if an engine speed is within a predefined range for a predefined period of time.

[c15] 15. The system of claim 12, further comprising means for calculating and storing a number of the correction factors in a memory based on an engine speed and an engine load occurring proximate a time of calculating the correction factor, wherein each stored correction factor is retrievable based on the speed and load.

[c16] 16. The system of claim 15, further comprising means for controlling an amount of torque produced by the motor/generator based on retrieving the correction factor stored for the speed and load that corresponds with a speed and load proximate a time of the transition.

[c17] 17. The system of claim 12, wherein the second torque estimate is based on current in the motor/generator, and wherein the second torque estimate is a more accurate estimate of torque from the first power source than the first torque estimate.

[c18] 18. The system of claim 12, further comprising means for storing four corrections factors in a memory such that a first correction factor is used to adjust the first

torque estimate during transitions occurring under low speed and high load, a second correction factor is used to adjust the first torque estimate during transitions occurring under high speed and low load, a third correction factor is used to adjust the first torque estimate during transitions occurring under low speed and low load, and a fourth correction factor is used to adjust the first torque estimate during transitions occurring under high speed and high load.

[c19]   19. The system of claim 12, further means for releasing the transfer brake and for controlling an amount of torque produced by the motor/generator during release of the transfer brake based on adjusting the first torque estimate according to the correction factor such that the amount of torque produced by the motor/generator matches the torque produced by the internal combustion engine within a predefined range.

[c20]   20. The system of claim 12, wherein the correction factor is a value determined by a difference between the first torque estimate and the second torque estimate.